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ABSTRACT

Project CAPABLE (Classroom Action Program: Aim: Basic Learning Efficiency) is a classroom approach which integrates the basic learning skills with content. The goal of the project is to use basic learning skills to enhance the learning of content and at the same time use the content to teach basic learning skills. These monthly reports explain how the basic learning skills can be taught in mathematics classes. One learning skill is covered by each monthly report. They include: Learning Skills; Comprehension Development; Vocabulary Development; Directed Reading Activity (DRA) and SQ3R (Survey, Question, Read, Recite, Review); Study Skills; Management Techniques; Structured Overviews and Study Guides; and Interest, Motivation, Assessment. (BS)

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MATHEMATICS

Project CAPABLE

CLASSROOM ACTION PROGRAM:

AIM: BASIC LEARNING EFFICIENCY

"to make each student a more capable learner"

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AUGUST REPORT

LEARNING SKILLS

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TITLE IV: PART C
DEVELOPMENTAL GRANT

MATH

Harry Shea

Basic Skills Needed in Mathematics

I. Study Skills

1. Note taking (from lecture or text)
2. Organizing facts and/or ideas
3. Understanding and following directions
4. Recognizing writing patterns
5. Searching (text or other sources) for fact/information.

II. Vocabulary Skills - Workable vocabulary background: general, technical, and symbolic.

1. Literal and symbolic decoding skills
2. Method to find meanings of new words through:
   A. Pronunciation
   B. Context use
   C. Structural analysis
   D. Use of dictionary, text or other sources
3. Recognition of phrases and their relationship to operations and relations.
4. Skills at translating words to symbols

III. Reading Skills

A. To read for different purposes
   1. Skim for general idea
   2. Pick out and understand what is being asked
   3. Scan for specific facts
   4. Understand and apply relations
   5. Read critically to check answers
   6. Read and comprehend graphs, figures, tables

B. Adjust speeds of reading according to purpose
   1. Reread till purpose is accomplished

2. Establish the purpose for a reading

3. Understand writing patterns to help devise attack

IV. Reasoning Skills

1. Conceptual background

2. Computational background

3. Three dimensional visualization

4. Organization of facts and/or ideas

5. Analysis of: relevance of facts
validity of arguments
reasonableness of answers

6. Generalizations, drawing conclusions

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SEPTEMBER REPORT

COMPREHENSION DEVELOPMENT

TITLE IV: PART C
DEVELOPMENTAL GRANT

MATHEMATICS

Harry Shea

Comprehension Requirements for Mathematics

Understanding of meanings of individual words or symbols of common words in mathematical context.

Understanding of meanings of phrases and their relationship with operations and relations

Understanding of meanings of larger language units;

- Sentences
- Paragraphs
- Chapter Segments

Understanding of various kinds of concepts:

- Numerical
- Spatical
- Symbolic
- Logical

Recognition of Writing Patterns (2 types)[1]

(1) Explanation: Comprehending Main Idea

Understanding and following argument patterns

- Logical
- Sequential
- Symbolic

Understanding supporting details

Understanding and applying relations

Understanding of illustrative figures, graphs, tables

(2) Problems or Concept testing:

Understanding Question being asked

Recognizing

Understanding given relevant facts/quantities

Understanding mathematical process required

Recognizing what information is implied but not stated

1- "Techniques for Improving Comprehension in Mathematics" Jane H. Catterson in G.G. Duffy (Editor) Reading in the Middle School, I.R.A., Newark, Del., 1974

Recognizing what information is needed but not given

Evaluation of validity of solutions

Understanding and following directions

Recognizing and understanding relation between author's organization and concepts discussed.

Understanding and translating words to symbols and symbols to words.

Mathematics is peculiar from other school subjects in that it is a very conceptual discipline and relies heavily on symbolic devices to convey information. In addition, the textbooks are usually densely packed in content material.[2] These are factors contributing to the fact that reading a mathematics textbook is not enough to insure comprehension.

Comprehension or understanding occurs on several levels. A model which is based on mathematics understanding is that of Richard Kemp, published in September, 1979. Kemp mentions 3 levels of understanding[3] instrumental, relational and logical. Instrumental comprehension refers to mechanical mathematics, such as applying a formula to a given situation. Relational comprehension occurs in cases where understanding requires tailoring a mathematical process to a certain situation, or combining several formulas to solve a problem. Logical understanding, the highest level, involves understanding the formal structure of mathematics and would involve things such as developing a formula, judging or creating a proof.

Kemp's model may be roughly compared with the six levels of Bloom's taxonomy. The instrumental level would include Bloom's knowledge ("State the quadratic formula.") and comprehension ("Solve this equation using the quadratic formula: $3x^2 - 4x + 1 = 0$). Relational understanding takes in application ("Solve $4(x + 1)^2 + 3(x - 1) = 12$) as well as analysis ("Based on

your knowledge of the quadratic formula, tell what kind of equation would not have any real solutions?") Finally, Kemp's logical comprehension would relate to synthesis ("Derive a formula to solve any quadratic equation.") and evaluation (Mathematically, evaluation would include evaluating arguments and proofs).

Classification of Question

Course: Algebra I (9th grade college track)

Text: Modern Algebra: Structure and Method Book 1, Dolciani, Wooton, Houghton Muffin Company, Boston; Revised Edition, 1970

Chapter 3 (Addition and Multiplication of Real Numbers)

" 4 (Solving Equations and Problems)

The Chapters are segmented within chapter topic and may be grouped within sub-topics. Oral exercises are listed at the end of each chapter section and are the simplest of the questions. Written exercises also follow every section and are grouped according to difficulty, labelled A, B, and C for progressively more difficulty.

In general, oral exercises are short answer applications of concepts which can be done mechanically. These fall within the instrumental level for the concept being learned with occasional relational questions. More often, there will be questions concerning instrumental use of the concept under discussion coupled with relational understanding of previously learned topics.

Written exercises will have sections of instrumental-type questions about the concept of that section as well as more difficult instrumental level questions involving other concepts at relational and logical stages.

The word problems consist of relational tasks, although the text offers occasional extra problems and Extra for Expert sections to stimulate utilization of logical thinking.

The texts closes out each chapter with a Chapter Test and Chapter Review. Those contain questions that are grouped by section or concept in such a way that they involve instrumental thinking but would require relational understanding if the grouping had not given clues as to what method is necessary for solution. Approximately three fourths of the questions are of this type. The rest are relational.

Comprehension is a function of the student's cognitive level, experiential background, and motivation; of the reading level of the text; of the nature of the task or purpose of the reading, and of the nature of instruction used to prepare and aid the student in learning the content.

Questions are a type of instrument used in the instruction and serve a dual purpose in the classroom. For the teacher's use, they diagnose acquired comprehension and areas of weakness. For students, they guide the student to the important ideas of the text. Over a longer period, questions help the student to create a strategy for learning from printed material.

Questions may apply to any of the various levels of comprehension. Researchers have found, however, that most questions refer to literal level understanding, requiring only short, factual answers. More questioning should be done on higher cognitive levels. Literal questions elicit literal answers, based on literal thinking only. Higher level questions would show students that different kinds of answers requiring more thought are expected of them. These types of questions require both longer, more involved answers and more time to think and formulate the answers.

Questioning strategies should cover the spectrum of comprehension, from the literal up through evaluative. Since higher levels of understanding rely on lower knowledge, questioning sequence is important.

Preparation of questions is important also. To be beneficial, questions must be worded so as to cover the desired cognitive level and be based on the students previous knowledge and comprehension level in the content.

Timing of questioning is also important. Post-questioning will tell the teacher whether the students learned what they should have, while pre-questioning gives the students clues to what they should study before they start reading.

The major goal should be for the internalizing of the learning process on the student's part rather than for the imparting of knowledge. The real world has no teacher at the front of the room. Questioning strategies can aid in this process. To begin with, questions reflecting all cognitive levels should be provided. Later, the numbers can be reduced or proportions altered, such as fewer literal and more analytic. Even later perhaps only one or two evaluative questions will lead to the complete understanding desired. And, finally, if the job is successful, the student will read and learn without any teacher questions. He will ask his own questions and thus the learning will be personal and more valuable to him.

2- "Reading in Mathematics and Cognitive Development" M.P. Bye, 1975 ERIC #124-926

3- "Richard R. Kemp in "Mathematics Teaching" #88, September 1979, (British Journal)

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OCTOBER REPORT

VOCABULARY DEVELOPMENT

TITLE IV: PART C
DEVELOPMENTAL GRANT

MATHEMATICS

Harry Shea

VOCABULARY

Vocabulary's role as the "mediator of thinking," to quote Manzo and Shirk,[1] should impress its importance upon teachers. For further emphasis, as well as a practical indicator to non-academics, i.e. students, is the citing of the correlation between vocabulary and job ability and advancement.[2] Vocabulary is an important part of our minds, affecting our way of thinking and our way of communicating with and relating to our environment.

It is worth mentioning that the purpose of reading is the conveyance of ideas. Mere recognition and decoding of words is insufficient. For meaningful reading, understanding must take place. Words must be understood; the ideas should be relatable to the reader's experience. A suitable vocabulary is required and a method for improving it-that is, for finding the meanings of unfamiliar words--is highly desirable.

The several vocabulary skills are applicable according to different circumstances, dependent upon which type of word is being examined. In general, perhaps the most useful guide to the meaning of an unfamiliar word is context. Included as contextual clues would be comparison or contrast, synonyms or antonyms, summary, association, and reflection on mood or situation.[3] In some writing, other clues are available to assist, namely illustrative clues such as graphs or diagrams. The word itself may hint at its meaning, through phonetic clues for clearer pronunciation or by structural analysis applied to the word's parts. And when all else fails, the dictionary is a resort.

Mathematics writing has its own character. Mathematics uses several types of vocabulary. There is the common usage of a general vocabulary. There are general words that have special meanings to mathematics. There are technical words often unique to math. In addition there are the abbreviations and symbolizations that are used to condense mathematical discussion.[4] Math writing

is usually densely packed with ideas. The course of explanation or argument depends upon very precise meanings. All these factors contribute to difficulty.

In order for pupils to get the necessary understanding from a section of text, certain measures are helpful, even necessary. In most cases merely assigning reading of a portion of text is not enough. Some pre-teaching is called for. Pupils must be able to understand the words, or at least to puzzle out the meanings, and to relate the ideas to their experiences.

Preparation by a teacher of a lesson includes identifying key terms and concepts, i.e. vocabulary, as well as appraisal of student's present level of understanding of those words. If an acceptable level exists, then simple review of terminology should suffice. If not, presentation of these key words should include pronunciation, a written (or printed) presentation of the word in context and discussion of meaning that would relate to the pupils experiences, giving them a handle on the new word.[5]

Text books use different writing styles, some giving more assistance in vocabulary meaning and development. The approach used by a teacher in preparing his class for a reading assignment will vary depending on the degree of aid furnished in the particular text used. A single factor that will determine meaningful understanding and learning is the active participation of the student. Reading is not a passive activity - thought must occur. Regardless of text or approach, the pupil must aid his own cause by doing, by thinking. Some form of self-recitation during reading or studying will be productive. Taking notes (the act of writing is reinforcing), keeping a glossary, or paraphrasing will further understanding.

Because Math texts are different, students need to be able to use a variety of techniques to fathom the meanings of unfamiliar terms. The several kinds of mathematics vocabulary will call for different approaches, applications of different ones of the vocabulary skills. General reading might follow a sequence

such as this, an assumption made that the student will attempt to find the meaning of a strange word rather than simply continuing in ignorance of the intended idea. He may glance ahead or reread the sentence or so preceding the one containing the unknown word, hoping to find contextual clues. Finding no help there, he may look for additional aid in the form of graphs, illustrations or diagrams. Lacking those, he might examine the word itself, looking for familiar roots and prefixes or suffixes. If he can't figure the meaning out still, he may resort to a dictionary. In mathematics reading, this pattern should be altered.

Dictionary referral, often the last resort, is of limited use. For the common language terms used in math writing, as well as all subjects, the dictionary can provide the general meanings. For general terms with specific math usages, it would usually not serve. For example, the mathematical sense of between (between 2 points but not including the 2 points themselves) is not explained in dictionaries. Likewise for technical words, dictionaries might not be precise enough. The same situation may apply to many abbreviations and symbols.

The solution to this predicament may lie in a mathematics dictionary, either the glossary provided in many texts or even a student maintained glossary. This latter would include important words entered into the glossary upon the student's encountering them the first time. Student's glossaries should be used in conjunction with the publisher's. Items would include symbols abbreviations, technical words and mathematical meanings of general vocabulary.

Since mathematics writing is very precise, contextual clues are often limited unless the point of the writing is the explanation of the unfamiliar term or concept. In that case, depending on the textbook, the explanation may serve as a definition, generally better suited to the student's particular need than glossary or dictionary.[6] This situation would be the ideal time for the

student to enter this term and definition in his glossary both for reinforcement of the idea and for future reference.

When the text is using illustrative clues to make a point, these should be heeded. Graphs, charts, photographs, or figures are helpful in demonstrating concepts that are difficult or complicated to write about.

Structural analysis is another vocabulary tool that may be productive, especially with the technical class of math vocabulary. Many roots and prefixes occur frequently enough to make their study worthwhile. Examples are -gon, polygon, hexagon, octagon; -nomial, binomial, trinomial, polynomial. The metric system makes great use of specific root units and numerical prefixes.

One method beneficial in understanding an unfamiliar term is the relating to previous occurences of the same or similar concepts in the student's background of experience. The previously studied portions of the text should be part of that background. The text should be a resource, not merely a list of assignments. Whether for help in cementing a new concept or as a reference for clarification of an unclear point in areas other than vocabulary, the mathematics textbook should be a handy and much-used resource.

To repeat some key ideas in content vocabulary development, (and in all learning), the purpose of reading is not only word recognition and/or vocalization. It is the conveyance of ideas expressed. Understanding must occur. Time and effort must be expended thinking about the ideas. The idea of "See, Say, Hear, and Write,"[7] serves to fix the words in all the student's vocabularies: listening, reading, writing and speaking. To remain, they must be able to relate them to their experiences and to use them.

The attainment of a particular concept progresses through a certain hierarchy of experience and understanding, from the concrete to the more abstract.

Specific level: Understanding is limited to a single aspect, idea or experience, very particular to the individual.

Functional level: Understanding includes use of, purpose of, and is broader in scope; several aspects.

Conceptual level: Understanding of idea of, including classification of that type, what is included or excluded; and of broader classification of which this is a part.

New Word - "INTERSECTION (of sets)" (Presumes understanding of Sets, Union (U), Venn diagrams)

SYMBOLIZATION "$\cap$"

Definition on specific level: "combination or joining of sets"

Activities: #1. Write a definition of set intersection.

#2. Match these:

_____I. Intersection	a) $\emptyset$
_____II. Union	b) U
____III. { }	c) $\cap$

Functional level: "a set containing the things in both sets"

Activities: #1. Find the intersection of the two given sets:

a) $\{1,3,5,9\}$ and $\{1,2,6,9,10\}$

b) $\{1,2,3\}$ and $\{\ \}$

#2. Place the elements appropriately in the Venn diagram.

A= $\{4,4,7,9\}$

B= $\{2,4,8\}$

Conceptual level: "the intersection of given sets is the subset made up of those members belongs to all of the given sets."

Activities: #1. Explain why our definition of intersection of sets can be applied to a street intersection.

#2. A = $\{1,3,5\}$; A$\cap$B = $\{1,3\}$; AUB = $\{1,2,3,4,5\}$

Find set B.

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NOVEMBER-DECEMBER REPORT

DRA & SQ3R

TITLE IV: PART C
DEVELOPMENTAL GRANT

MATHEMATICS

Harry Shea

A prime concern for content area teachers to remember is that, contrary to any understandable predudice, content area knowledge should not be the main goal for their pupils. The goal should be for the pupils to be able to function independently in that area. This means, rather than importing information, teachers should be enabling by their instruction the pupils to learn and use the material. In short, don't teach math; teach how to learn math.

Reading is indispensable for learning, although it may have other purposes. Pupils do not always recognize any difference in reading style and their learning suffers if they read math as they would read a magazine article on sports. Reading to learn requires an activity involved student. Motivation to learn is not enough, if the reading is not properly directed or attention concentrated.

Several devices have arisen to provide guidance to students in reading content material. Some are Directed Reading Activity (or Lesson), Survey Question-Read-Recite-Review (SQ3R), SQ4R or SQ5R. Their purposes and advantages are these: they actively involve students in the reading. They prepare students because the lesson is previewed and unfamiliar words and concepts are spotted and can be explained. They guide students to important points through the prequestions. They provide practice and reinforcement through the recite or discussion stages. They counteract the forgetting process with reviews or follow-up activities, and they work - if used.

These methods can be related to learning theory to explain their effectiveness. In previewing or skimming or introducing a new lesson, the student is preparing to take in and process new information which mind can do better if it knows what to expect. By questioning himself before he reads, the student sees what he knows and what he doesn't, so he can concentrate on needed information. He must have these things in mind (general idea and question to answer) while he is reading; he should not read passively - little or no learning would occur.

Recitation makes the student react, either by verbalizing his knowledge or writing in notes or by anticipating what will appear beneath a cover card. The review step is a countermeasure for the curve of forgetting.[1]

All the named methods contain similar basic elements - preparation, active reading, attention focusing devices, reinforcement activities. They differ in the types of these devices, as well as the agent of responsibility - pupil or teacher. Different devices are dictated by different circumstances.

As always, lessons should be previewed by the instructor, but SQ3R provides for the student to Survey or Skim the material himself. Whether the purposes for the reading are teacher - or student-generated or jointly-derived, they must be set prior to the reading. Previewing does not require more time for a lesson. Contrarily McCluskey reports a 24% shorter time requirement because the preview makes the rest of the learning more efficient.[2]

Questions focus the mind on the important matters. These can come directly from headings being reworded, from italicized or bold print phrases. Holmes found use of pre-questions produced better retention on those items (the subjects of the questions) and equal or better retention on other items not pre-questioned, than when no pre-questions were used. This differential was especially noticeable after a two-week period.[3]

Washburne noted that a set of pre-questions were most effective when the questions were considered immediately prior to the reading of the section containing the relevant material.[4]

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[1]Tadlock, Dolores Fadness, "SQ3R - Why it Works, Based on an Information Processing Theory of Learning," Journal of Reading, Vol. 22, No. 2: Nov. 1978 p. 111.

[2]Robinson, Francis P., "Study Skills for Superior Students in Secondary School," Improving Reading in Middle and Secondary Schools, (New York: Macmillan Publishing Co. Inc., 1974) p. 187.

[3]Robinson, Francis P., p. 188.

[4]Robinson, Francis P., p. 189.

Tadlock stressed the desirability of student-generated questions,[5] which would be reasonable in that the motivation would be more internalized than with teacher questions. Shepherd pointed out that higher-level questions are needed[6]- literal questions producing only literal understanding. But the most important question for any student to ask himself is "So I understand?"[7]

The review phase is important. Washburne found a test-like review immediately after the reading effective, reducing forgetting from the normal 80% in the first 24 hours, to only 20%.[8]

"In mathematics, the patterns are fewer and the amount of reading is quite reduced. But the intensity of writing in mathematics is perhaps the greatest of all the areas. Indeed, the student may find that he has to read word-by-word in some problems and theorems. Such a mode of reading is usually frowned upon in subjects such as English and the Social Studies. The patterns usually found in mathematics are explanation of process with a step-by-step example, definition and following directions."[9] Therefore, it is incumbent on the math teacher to instruct the student in reading of mathematics so the student can function in his area.

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[5]Tadlock, Dolores Fadness, "SQ3R - Why it Works. Based on an Information Processing Theory of Learning," Journal of Reading, Vol. 22, No. 2: Nov. 1978, p. 111.

[6]Shepherd David L. Comprehensive High School Reading Methods, (Columbus, Ohio: Charles E. Merrill Publishing Co. 1973) p. 173

[7]Tadlock, Dolores Fadness, p. 111.

[8]Robinson, Francis P., p. 189.

[9]Shepherd, David L., "Content Area Reading," ERIC #155687, Nov. 1977, p. 9.

An introductory device and a demonstration of the effectiveness of SQ3R would be effective. This might take the form of a short (5 minute) reading assignment followed by a short test. After this, an explanation and demonstration of SQ3R followed by another reading and test should show its effectiveness and motivate students to adopt it into their studying repertoire. A few more in-class demonstrations or "run-throughs" and a few duplicated forms for a few more assignments should provide enough familiarity for the students to make use of SQ3R. Of course, the assignments must cover all of the 3 main writing patterns found in mathematics.

A Directed Reading - Thinking Activity

Mathematics

Author - Dolciani; Wooton

Title - Modern Algebra: Structure and Method Book

Pages - 204-206 - Adding Polynomials

Suggested Level of Book - Freshmen-College Prep

I. PREPARATION

A. INTRODUCTION AND MOTIVATION

Give a figure whose sides have lengths which are simple. Polynomials in like terms. Ask students to find perimeter. Show them that they are creating polynomials.
Showing formulas for perimeter, area, volume of several figures. Show that these are polynomials.

B. CONCEPT CLARIFICATION

Commutativity, associativity, distributativity (in practice) simplification

C. "WORD STOPPERS" - VOCABULARY

Polynomials - monomial
binomial
trinomial
Degree of polynomial
Simple form (of Polynomial)

D. SKILL DIRECTION

(Old skills)	Identify:	Numerical Coefficients
		Like terms
(New)	Combine like terms	
	Adding polynomials	

E. PURPOSES FOR READING

To learn what a polynomial and identify different types. Learn what "Degree of a Polynomial" is and How to determine it. Learn how to add polynomials.

II. SILENT READING

III. COMPREHENSION CHECK

Oral exercises in class - adding polynomials; stating degree also -

Identify polynomial types and give examples of types and examples of what is not a polynomial.
Homework assignment - written exercises (p. 208 #2-36 even)
Discuss homework in class.

IV. FOLLOW-UP ACTIVITY

Addition of polynomials is used in subsequent assignment - subtraction of polynomials.
Cross-number puzzle using addition and subtraction of polynomials.

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Project CAPABLE

CLASSROOM ACTION PROGRAM:

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"to make each student a more capable learner"

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English

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JANUARY REPORT

STUDY SKILLS

TITLE IV: PART C
DEVELOPMENTAL GRANT

MATHEMATICS

Harry Shea

STUDY SKILLS

Study skills are those skills which enable a student to acquire the understanding to answer questions on, make judgements about, report on and apply knowledge. The skills are of several types, concerned with locating and obtaining information through research techniques or special study aids, remembering information through appropriate study and practice methods, and using the acquired information after evaluating and organizing it.

These study skills need to be taught. Too often the teacher assumes the student has the necessary proficiency in those areas, or tells the student about the techniques and assumes the student has thus gained the skills and will use them. Such a scenario usually fails.

Study skills provide a method of attack against a problem, but some points are worthy of mention. Generally any systematic approach is better than none,[1] and no single approach will suit all circumstances. Flexibility is indicative. Research has not shown a conclusive advantage to study skills being taught, possibly due to a lack of well-designed research projects. However, one finding has shown an increase in the academic self-confidence and enthusiasm of students so equipped. This latter point seems a worthy gain.[2]

All the study skills presume the ability to read. Reading is not enough, however. To retain the material, the student needs a method, such as SQ3R, to create an active study process, instead of a passive absorption of information.

There are special aids which provide, in compact form, a clear representation of many facts or of relationships between ideas. The student needs to avail himself of these devices, such as maps, graphs, and cartoons.

None of us always have enough knowledge to make the best decisions and we, therefore, need to acquire more. The student needs the research skills to gather data (for school reports or personal judgement) from his own text or from other suitable sources.

Being faced with mountains of facts, the student needs to sort out relevant from irrelevant, recognize main ideas, and separate valid statements from invalid statements.

To facilitate his conveying of ideas to others, the student needs to organize his knowledge in a form so he can express it meaningfully. For his own use, he must summarize and organize his knowledge so it makes sense to him, is easily retainable, and can be recalled and reused in the future.

Study skills may be broken up into several categories, with some overlap. Obtaining information, evaluating data, orgainizing and/or summarizing, retaining information and using special study aids.

Obtaining information: student needs to be able to locate information through use of:

-alphabetical arrangement

-table of contents

-index

-appendix

-glossary and/or dictionary

-encyclopedia

-almanac

-card catalog

-Reader's Guide

-library classification system (Dewey or Library of Congress)

Evaluating data: (Some evaluation will have been done by student in choosing sources student should be able to

-state main idea

-locate topic sentence

-recognize important details

-recognize the importance of context

-recognize the importance of context

-realize the author's purpose

-judge relevance of material

-verify facts or accuracy of statements

-accept or reject statements

Organizing and summarizing data: student needs to be able to:

-recognize and use organizational patterns of time, cause and effect, comparison or contrast, main idea and enumeration

-skim

-follow directions

-determine relationships between/among concepts

-summarize paragraphs/longer passages

-outline paragraphs/longer passages

-take notes from lecture or printed material

Retaining information: student needs to:

-use SQ3R (or other suitable study technique)

-see relationship between directions and purpose for reading

-set own purposes for reading

Use special study aids: students must be able to extract information from:

-maps

-graphs

-charts

-tables

-diagrams

-cartoons

-scales

-legends

-symbols

-keys

Under the topic of obtaining information, the mathematics students needs to be able to use alphabetic arrangements, tables of contents, indexes or appendices and glossaries in the text or in other technical books. The text should be a reference book as well as a source of practice examples.

To evaluate data, a math student must understand the main idea, recognize important details and sort out relevant facts whether it be for following an argument or proof, or for solving a problem.

Organizational skills must include following directions as well as skimming, relating ideas and notetaking.

To retain what is learned, the math student needs to apply a suitable study method such as SQ3R, set his own purposes for reading (learning information versus problem-solving) and understand relationships between purpose and directions.

The student must be able to gain information from graphs, charts, tables, and follow arguments when they refer to figures. He must understand their relevance to text material. In mathematics, many concepts are difficult to explain or demonstrate, except through use of these devices. Mathematics being a highly symbolic language, it is imperative that the student comprehend both the literal material and the often parallel symbolic statements.

In teaching study skills, one need remember several points. The student will use a skill as it applies to a particular content area. Therefore, he needs to learn it in the context of that field and should be taught by the content teacher.

All the study skills presume reading ability. Needless to say, individual differences must be considered and teaching material or technique altered as necessary.

Teaching the skills means guiding the student, not just telling how. Also, the student needs to practice in increasingly more difficult steps, mastering a level before progressing to a higher one.

A skill learned is not an ultimate goal. These skills are but tools to enable the student to learn more and do more. As his knowledge increases, his need for a certain skill will progress so he will need higher levels of that skill.

[1]Manzo, Anthony V., and Casale, Ula, "A Problem-Solving Approach (PSA) to Study Skills... A Sophisticated Teaching Strategy for the Reading/Learning Specialist" ERIC #147782, November, 1977, p.7.

[2]Reid, Neil, "Developing Study Skills in the Reading Process" ERIC #154333, August, 1975, p.28.

A Directed-Reading - Thinking Activity

Mathematics

Author Dolciani and Wooton

Title Bk1: Modern Algebra-Structure and Method

Pages 355-359

Suggested Level of Book Grade 9 - 3rd Quarter Algebra

I. PREPARATION

A. INTRODUCTION AND MOTIVATION

Show examples of tables and graphs from newspapers/magazines
Show paragraph form of same information
Compare convenience

B. CONSUMER CLARIFICATION

Function - Domain - Range
One - to - one correspondence

C. "WORD STOPPERS" - VOCABULARY

Bar graph
Pictorial graph (pictograph)
Broken - Line graph
Co-ordinater - 1st co-ordinate; 2nd co-ordinate
Equal ordered pairs

D. SKILL DIRECTION

Read a Table - specify units for given figures
- extract ordered pairs of data
Read graphs (various types) - extract same information as for above

E. PURPOSES FOR READERS

Define/identify bar-, picto-, broken-line graphs
construct graphs
define - ordered pairs
- equal ordered pairs

II. SILENT READING

III. COMPREHENSION CHECK

Given info-student must construct - table
bar graph
picto-graph
broken-line graph

Given ordered pairs - determine if equal

IV. FOLLOW UP ACTIVITY

P. 358 #2-20 even - (construct bar graph, broken-line graph, pictograph from data in given tables)
(use "equal ordered pairs" concept to solve equations, find values of variables)

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Project CAPABLE

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Gisele Roy
English

Harry Shea
Math

FEBRUARY REPORT

"MANAGEMENT TECHNIQUES"

TITLE IV: PART C
DEVELOPMENTAL GRANT

PT2

MATHEMATICS

Harry Shea

MANAGEMENT TECHNIQUES

Under ideal circumstances, every student would have his own teacher who could cater to the student's mode of learning, provide materials and instruction techniques most suited to the student's needs and abilities, and constantly monitor and evaluate the student's achievement to readjust technique and content of teaching. The real world doesn't afford such a luxury. Pressures of budget time, and duties more often produce situations where one instructor teaches from 25-40 students as a group, using the technique the instructor feels most appropriate for reaching most of the group. Yet, there are compromises between this exigency and the ideal.

Large group instruction has some obvious drawbacks. Plainly, one technique or approach can not work best for everybody; not everyone learns at the same pace. Large groups do not allow for a lot of contribution from everyone.

Smaller group instruction to counter the disadvantages of whole class instruction carries with it some further duties. Needs and achievements must be assessed to a greater degree in order to determine group types, techniques, and materials to be used. More planning is required in terms of classroom management of students and materials at various levels of difficulty. Efforts should be taken to explain purposes and goals to students, as well as, to involve them in the setting of purposes and in the evaluation, perhaps along with the determining of groupings. More training may be necessary for students in group methods because more independence is required in group situations.

The variety provided by smaller group instruction of different types, or simply as a change from lecture approaches, should counteract monotony. Tailoring materials and approaches to students should provide successful learning. Greater opportunity for student participation in discussions as well as in setting purposes and in evaluation should improve interest and motivation. More opportunity to work at his own pace and more feedback from his peers are other advan-

tages to be gained from instruction methods using smaller groups.

TYPES OF GROUPS

Name	Advantages	Disadvantages
Whole class: Introduction of new concepts; class discussion, speakers; reports	Simplest planning	Wide range of abilities, competence, interests
Achievement: Based on same skill level	Use materials at students own level	May carry stigma for slower groups
Task: Complete a certain project.	Allows practice and independence	Limited to scope of task
Interest: Based on common interests.	Allows practice; highly motivational	May not broaden experience with topics
Social: Based on same (or different; depending on goals) social levels.	Contact with different viewpoints	May not widen acquaintances
Small groups: Pairs or trios or Tutorial	More capable students assist slower-learning ones	May exploit students
Individualized: one-to-one	Maximum opportunity for student participation, for student-teacher inter-action	Maximum planning, differentiation of materials required; (May outrun time, personnel, material limits)

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Project CAPABLE

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English

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MARCH REPORT

"STRUCTURED OVERVIEWS & STUDY GUIDES"

TITLE IV: PART C
DEVELOPMENTAL GRANT

MATHEMATICS

Harry Shea

In preparing a lesson for secondary mathematics students, several steps are prescribed. The first is to determine if the lesson is necessary. That is, does it contribute to the goals and purposes of the course? Is it necessary for the student's adequate performance in either later courses or in the real world? If the decision is made that the lesson should be taught, then it is necessary to properly prepare the lesson.

In preparation, the teacher needs to analyze the material to be taught for the major concepts. As well, the vocabulary of the content should be analyzed for technical terms, specialized meanings of general words - an occurence relatively common in mathematics, and the symbols used to represent those terms or concepts. In some instances, this list of technical terms serves also to point out major concepts of the content. Thirdly, the content should be examined for the skills that are needed.

When the major concepts, vocabulary, and skills are identified, the material should then be organized for meaningful presentation to students. An introduction should be used that relates the material to students' experience, creates interest, reviews previously learned skills and concepts, and establishes the purposes for the study of the content.

One useful organizational format is the structured overview. This is a schematic representation showing interrelationships of the key terms and concepts with previously learned concepts. This format focuses the student's attention on the key concepts as well as providing an introductory context for a group of unfamiliar terms. The overview also relates terms and concepts so the student's comprehension is enhanced.

To construct a structured overview, the technical vocabulary should be listed for the material to be learned. This list should then be arranged in a form to display the interrelations between terms. Applicable previous terms (concepts)

should be added to this diagram to provide students with familiar information as a reference. This diagram should be referred to frequently during the course of studying a topic and added to as more concepts are learned.

The form of an overview will vary according to content taught. It might be a time line or sequence format. It might be a Venn diagram showing relationships between sets. For processes, a flow chart may serve. In hierarchy relationships, an outline form may be called for. Other diagrammatic forms are possible. To be remembered during the use of any structured overview is that the students must understand the format so they are learning the content.

One benefit of structured overviews also may obtain with study guides. That is the improved comprehension due to a pre-organization of concepts. When new data is seen in relation to previous knowledge or as part of a meaningful structure, it is more easily assimilated by the mind.

Study guides may be of different types. Some are designed merely to help students manage the reading of an assignment. These process guides, usually margin notes or inserts to be attached to margins, are used while reading the text. They contain cues that point out writing patterns or relationships (such as "cause-effect," "compare-contrast") or signal words (such as "watch for ideas after "however") or that help explain (such as "domain" is a synonym for "replacement set")

Others are designed to point out or to lead to consideration of key facts, ideas or relationships. These content guides may take form as questions ("what are the circumstances necessary for a fraction to be undefined?"), tables or outlines to be completed or as directions to follow in reading and analyzing material ("Follow example 2 and use the same method to simplify $\frac{5x^2 + 30xy - 10y^2}{5x}$")

Certain points are worth mentioning. Study guides are intended to aid students in reading and comprehending and retaining content or concepts. They must make their way through the reading before they can learn the content. In learning

patterned or related data, they can also be taught the pattern and how to learn the pattern. By using the organization of the study guide, they can learn the content more easily, but they should themselves learn how to organize for improved learning. Students are at different levels of comprehension with respect to a subject, so guides for them should address different levels. Monotonous use of guides may tend to lead students into reading for answers to the guides rather than reading to learn. As use of a guide brings results, the guide should be modified (or discontinued) so students will come to work at increasingly higher levels of comprehension.

Example of structured overview, to be used with Modern Algebra: Structure and Method by Dolciani and Wooton, Boston: Houghton Mifflin Co., 1970.

"Graphing Functions and Relations; Graphs of Linear Equations in Two Variables" pp. 355-373.

TERMS: Ordered pairs

1st component: 1st co-ordinate: abscisser

2nd component: 2nd co-ordinate: ordinate

Graph

horizontal axis origin

vertical axis

quadrants (I-IV)

Plane rectangular co-ordinate system

Graph of a point; of a linear equation and 2 variables.

(Underlined parts or comments in parentheses relate to previous experience. Broken lines demonstrate relationships)

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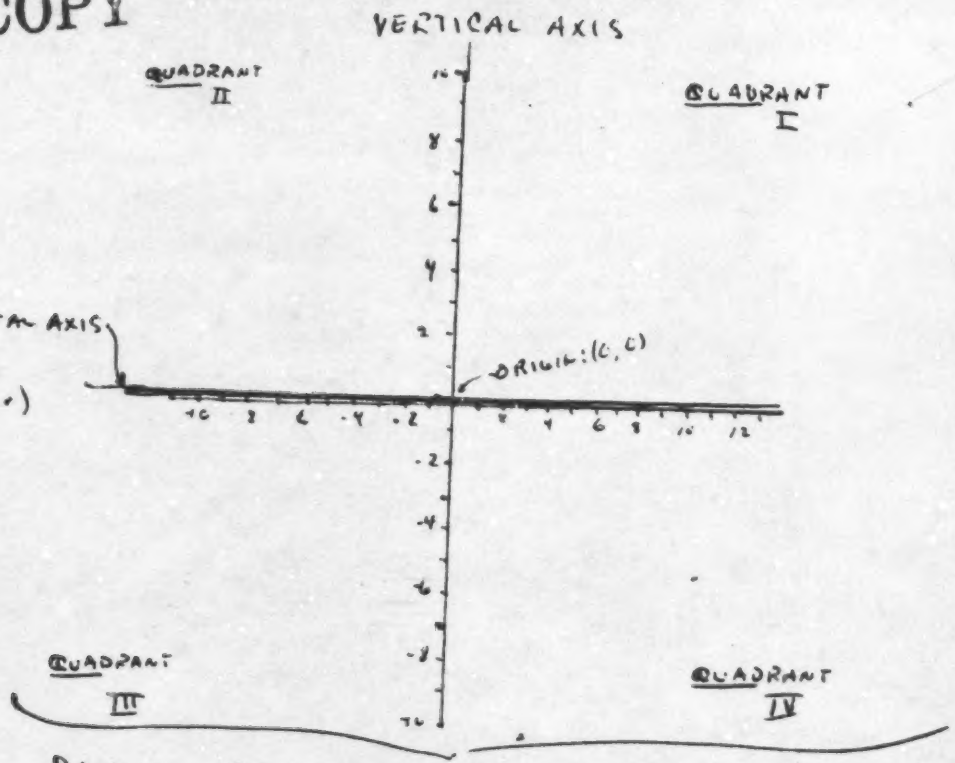
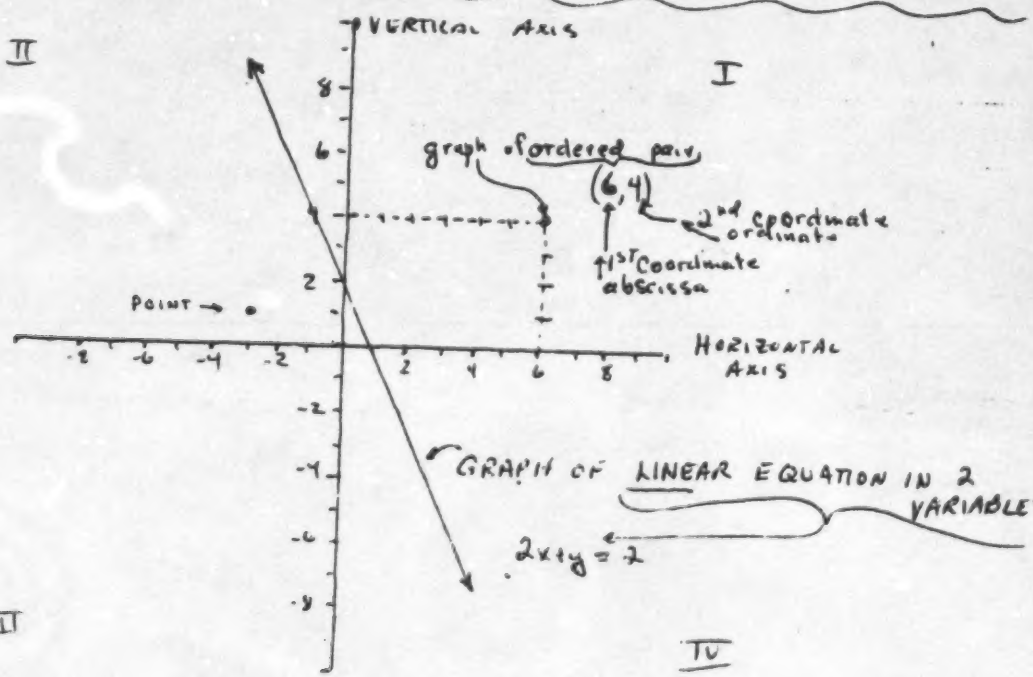


PLANE RECTANGULAR COORDINATE SYSTEM



STUDY GUIDE FOR SECTION 10-1; Functions Described by Tables

1. Does the table titled CENTRAL COUNTY represent a function?

2. List the ordered pairs that represent the correspondence between the paper and the average daily circulation.

3. On the bar graph on page 356, what is the Journal's circulation?

4. On the pictograph on page 356, how do you know the Examiner's circulation is 16,000?

5. Explain the difference between a broken line graph and a bar graph?

6. On the broken line graph, bottom of page 357, titled COLLEGE GRADUATES IN USA,

   a. Where do you find the domain?
   b. " " " " the range?
   c. List the elements of the domain.
   d. " " " " " range.

7. Does (1940, 200 000) mean the same as (200 000, 1940)?

HOMEWORK: Page 358 - #2-20 even. (Given tables, construct bar, broken line, and picto- graphs. Determine values to make two ordered pairs equal.)

STUDY GUIDE FOR SECTION 10-2: Coordinate in a Plane

1. What is an ordered pair of numbers?

2. What does vertical mean? Horizontal?

3. What is a horizontal axis?

4. What is a vertical axis?

5. What is the point called where the horizontal axis crosses the vertical axis?

6. Why is the point (5,3) different from the point (3,5)?

7. a. The abscissa is another name for what?
   b. The ordinate is another name for what?

8. Describe the process you would use to graph:

   a. the point (7,-3).
   b. the point (a,b).

HOMEWORK: Page 362 - #2-22 even. (Plotting ordered pairs. Given 3 vertices of a rectangle, find the fourth and name its coordinates. Plot points with only a description of abscissas and ordinates, rather than specific numbers.)

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BIBLIOGRAPHY

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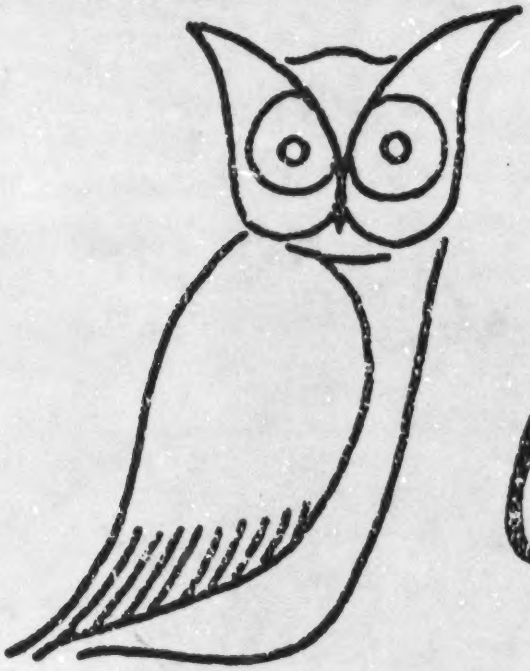

Project CAPABLE

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English

Harry Shea
Math

APRIL - MAY REPORT

INTEREST, MOTIVATION, ASSESSMENT

TITLE IV: PART C
DEVELOPMENTAL GRANT

MATHEMATICS

Harry Shea

The object of Project Capable is to design and implement an instructional program that will help each student become a capable learner through the acquisition of basic learning skills. In such a program the skills are met in the context of a particular content area so that skills and immediate practical applications are learned.

Evaluation is "the process of determining the value or effectiveness of an activity for the purpose of decision making," where value means "the cost in relation to the benefits" and effectiveness is "the difference the program has made."[1]

To evaluate the project, some key questions need to be answered. Is the program teaching the basic learning skills? Is the mastery of those skills an advantage in the learning of mathematics?

The information needed for making an evaluation is in several categories. Knowledge is required of the basic skill levels of students before exposure to the program, as well as mathematical skill levels. Also data is required on their mastery of those basic skills as well as math skills after experiencing the program. Knowledge of mathematical aptitudes is important for comparison of groups and their effectiveness of studying basic skills.

The source of necessary information will be two Algebra II classes, comprised of a range of college preparatory students from sophomores to seniors taking this 3rd year high school mathematics course.

Instruments to be used are Iowa Test of Educational Development's achievement tests for mathematical performance as well as for some study skills. For more specific items informal tests will be used as both pre- and post-test.

---

[1] Program Evaluators Guide, California State Department of Education. Published by Educational Testing Service, Princeton, N.J., 1979.